Appendices

GLERL Strategic Plan 2016-2020

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Appendix B. GLERL Succession Plan: 2016 - 2020

GLERL's succession plan provides guidance for staffing over the period of 2016-2020. The plan, last updated in 2014, reflects final actions required to complete the laboratory's re-organization and to address immediate staffing needs. The 2014 plan has been fully implemented with all recruitment actions in progress or completed. The current organization of GLERL and associated positions are shown in Figure 1.

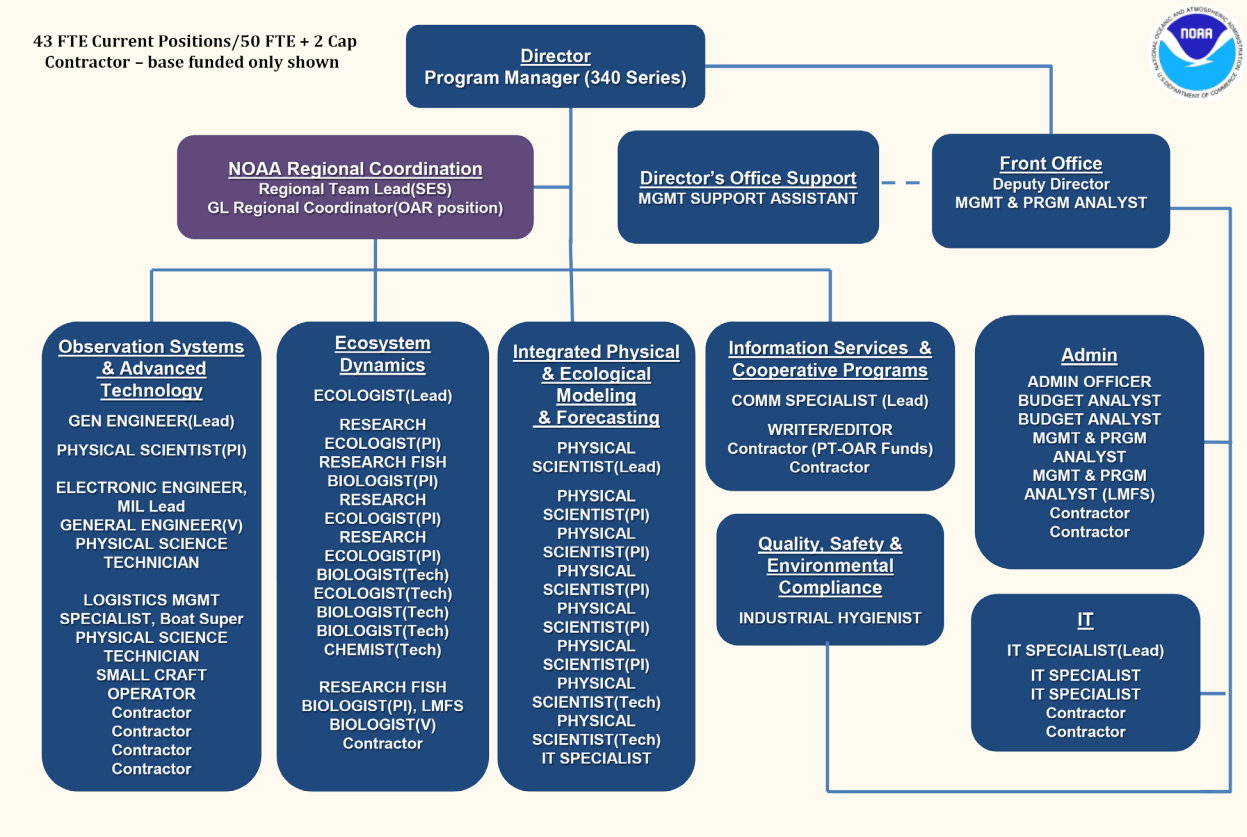


Figure 1: GLERL current positions and organization based on 2014 staffing plan

Presently, GLERL has 43 current federal full-time-equivalent (FTE) positions. In mid-2015, NOAA OAR re-assessed its cap on federal positions for all laboratories and programs and GLERL was allotted a cap of 50 FTE plus 2 reimbursable positions. In 2015, the total base cost per year of the federal salaries plus contract costs was $6,151,300 per year.

Considering the constraints of the new FTE cap and expected level base funding, as well as expected retirements in critical positions within the next 5 years, GLERL leadership has identified the need for a new staffing plan as part of the 2016-2020 Strategic Plan. In September and October of 2015, input on staffing needs was solicited from GLERL's four branches as well as from the following infrastructure teams: Administrative Services; Information Technology; and Quality, Safety and Environmental Compliance. The input was received, summarized and presented on October 15 to the branch and team leads, with Union representation present. Initial discussions were conducted on staffing plan alternatives. A second meeting took place on October 29 to resolve remaining questions, further consider alternatives, and finalize a

proposed plan. One additional discussion took place amongst the science branch chiefs to confirm the proposed new positions.

The following guiding principles were provided as the basis of the staffing plan discussions:

- Balance staffing across branches.
- Prioritize staff positions based on the following criteria:
  - Meet cross-branch needs.
  - Address gaps in science/service.
  - Enable NOAA priority missions:
    - Ecosystem Forecasting Roadmap (Resiliency).
    - National Water Center (Evolve NWS).
    - Invest in Observational Infrastructure.
    - Accelerates Research to Operations (Organizational Excellence).

The set of parameters used to guide the discussions included:

- Set the starting point for today looking to the future.
- Base decisions on positions not people.
- Develop plan through consensus.
- Recognize of the following constraints:
  - FTE cap (50 base + 2 reimbursable).
  - Base Funding.
- Consider only GLERL base-funded federal permanent positions:
  - Affordable new positions.
  - Converting contract to federal positions.
  - Re-classifying existing positions.

It was further emphasized that any new plan would have no adverse action on existing positions and reorganization was not being considered as this time.

As a result of meetings between each of GLERL's branches, the following positions were proposed:

Observation Systems and Advanced Technology

- Add Vessel Operations Marine Technician (focus on instrumentation Operations and Maintenance) – reclassify existing Physical Science Technician position via accretion of duties.
- Add Vessel Operations Vessel Captain/Marine Diesel Mechanic (new position).
- Reclassify Small Craft Operator to Physical Science Technician.
- Add Advanced Technology Engineering Principal Investigator (PI) (year-round under-ice observations—new position).
- Add Satellite Remote Sensing Principal Investigator (succession planning for existing position).

Ecosystem Dynamics

- Add MOCNESS and Larval Fish Tech (new position).
- Add Experimental Field Tech with radioisotope skills (reclassification of existing position).
- Add Nutrients Tech with radioisotope skills optional (reclassification of existing position).
- Add Data Tech (could be cross-branch—new position)
- Add Primary Production /Microzooplankton to fill gap in foodweb team (PI—new position).
- Add Biophysical Modeler (PI) (could be cross-branch—new position).

Integrated Physical and Ecological Modeling and Forecasting

- Add Atmospheric/Coupled Modeler (support).
- Add Observational Oceanographer (PI) (could be cross-branch—new position).
- Add Ice Analysis and Modeling position (support—reclassification of existing position).
- Add Probabilistic Nutrient Modeler (support—new position).
- Add Watershed Hydrology Modeler (PI).
- Add Hydraulics Modeler (PI).
- Add Atmospheric Modeler at Weather Scales (PI).
- Add GIS/Data Management Tech (cross-branch —new position).
- Add Biophysical Modeler (PI) (could be cross branch—new position).
- Add Web Developer/Programmer (cross branch—new position).
- Add Wave Modeler for FVCOM coupling (new position).

It was noted during the discussion that the Watershed Hydrology Modeler and Hydraulics Modeler could potentially be combined into one technical support position.

Information Services and Cooperative Programs

- Part-time Graphic Designer (contract)
- Program Specialist (contract)

It was noted during the discussion that although these positions are already in place, it would be desirable to convert them to one full-time federal position, if possible.

Quality, Safety and Environmental Compliance (QSEC)

- QSEC Part-time Support position:
  - at Lake Michigan Field Stations (LMFS).
  - at GLERL.

Discussion centered on whether this staff need could be met through a student, CILER, student federal position, or through the Veterans Rehabilitation Vocational Program.

Information Technology

- IT Specialist (convert HPC contract position to federal position).

- IT Specialist (convert Mission Support contract position to federal position).

It was noted that cost efficiencies could be gained in the interim by moving these two positions under one contract agency and that the Mission Support position could initially be a Pathways Student position leading to a permanent full-time position.

Administrative Services and Executive Office Support

- Reclassify Budget Analyst to Acquisition Specialist (DPA/COR).
- Front Office Administrative Assistant positions (convert the two contractors to federal positions).
- Reclassify Executive Office Management Support position to Program Management.

Following presentation and discussion of staff input from each branch and infrastructure team, it was recognized that the needs delineated for FTE positions far exceeded the authorized FTE cap and available base funding required in support of the positions. To help address this situation, it was note that converting several of the contract positions to federal positions (identified positions were federal prior to the last hiring freeze) would yield significant cost savings, and would free base funding for maximizing the proposed new federal positions.

Discussion then turned to identifying new positions that filled cross-branch needs to maximize the benefit of allocating the limited FTEs. These positions were identified as:

- Biophysical Modeler
- GIS/Data Manager
- Web Developer/Programmer
- Observational Oceanographer/Advanced Technology Engineering

Through the course of the discussion, the need was recognized for GLERL to achieve compliance with Federal Executive and NOAA Administrative Orders on managing its data as an asset. Compliance is becoming more urgent and compelling as staff managing large and important data sets retire or approach retirement. Filling a position of Data Manager was considered an essential first step, but additional roles and responsibilities would need to be distributed among existing positions. Development of a data management plan to address data management administration, information technology, data documentation and data publication is provided in the 2016-2020 Strategic Plan (Appendix G; currently in progress).

A final alternative staffing plan was achieved by consensus of the group (director, deputy director, branch chiefs, team leaders and Union representative) that is presented below.

- Contractors previously identified for conversion, converted to federal permanent positions
  - Administrative Services Team – two front office Administrative Assistants
  - Information Technology Team – two IT Specialists
- Reclassification of four positions
  - Administrative Services Team – Budget Analyst to DPA/COR

- Executive Office – Management Support Assistant to Program Manager
- OSAT – Physical Science Technician to Vessel Operations Marine Technician
- OSAT – Small Craft Operator to Physical Science Technician

- 3 new positions added
  - Ecosytem Dynamics - Coupled Biophysical Modeler
  - IPEMF - GIS/Data Manager
  - Information Technology - Web Developer/Programmer
- 50 FTE Total
- Total base cost per year = $6,295,600

The plan will add three new positions while only increasing costs by $144,300, thus remaining under the 50 FTE +2 Reimbursable cap. The new proposed staffing plan is shown in Figure 2.

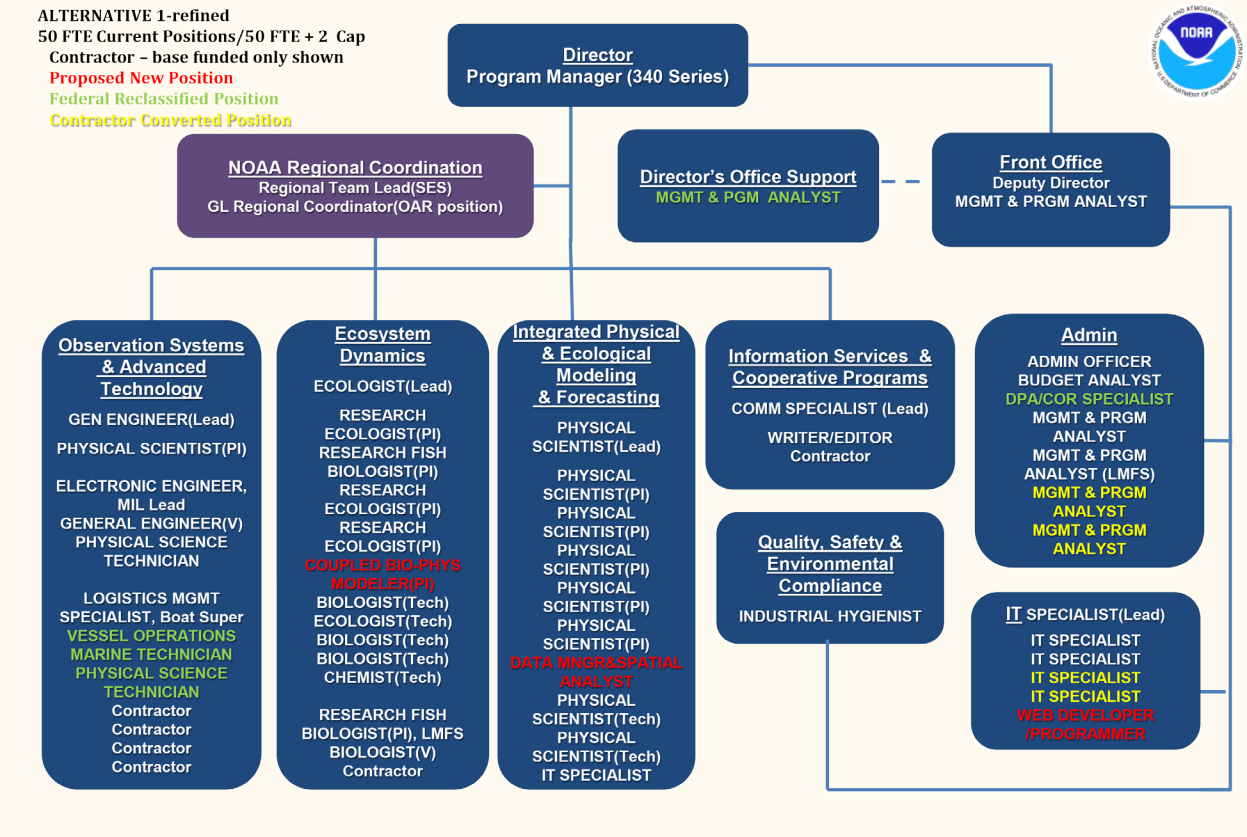


Figure 2: GLERL staffing plan proposed for 2016-2020.

Succession planning will be addressed through two approaches:

- Create CILER student positions for technicians and support staff funded from base projects, anticipated and built into fiscal year annual operating plans.
- Use Pathways Program as appropriate, requesting over-hire FTEs for Pathways Students.

The two reimbursable positions will be determined based upon funding received from anticipated

reimbursable projects:

- Chief Scientist's FY17 R2X Program
- Integrated Water Prediction FY17-FY18
- GLRI
- Climate Program Office
- Other

At present, the two reimbursable positions are being fully utilized by existing projects. Additional reimbursable positions will be requested on an as needed basis, dependent upon approval.
Execution of GLERL's Succession Plan for 2016-20 is currently moving forward, guided by discussion with Work Force Management in partnership with GLERL's Union.

Appendix D. The Lake Michigan Field Station and Vessel Operations

GLERL's Lake Michigan Field Station (LMFS) and Vessel Operations are valuable NOAA assets that play a critical role in supporting integrated scientific research on the Great Lakes ecosystem. Strategically positioned on the eastern shore of Lake Michigan, the LMFS provides both small boat and deep-water docking capabilities for GLERL vessels. The operation of GLERL's vessel fleet, in conjunction with the field station, provides the infrastructure necessary to promote Long Term Research (LTR) observations, field work, and process studies essential for understanding the Great Lakes ecosystem and the ecological services provided by the lakes. The location of the LMFS and vessels on the shores of Lake Michigan also enhances GLERL's connection to the local and regional community, further supporting NOAA's role in freshwater ecology, ecosystems management, coastal management, and water-based commerce.

GLERL's Lake Michigan Field Station, located on Lake Michigan's Muskegon Lake Channel, is comprised of three buildings with laboratory facilities, housing research staff, vessel crew, a marine superintendent, and administrative personnel.

To effectively support scientific advancements over the next five years, capacity planning of GLERL's LMFS and Vessel Operations is critically important. Planning must be responsive to future science priorities— including consideration of project ideas and proposals— as part of the process to assess infrastructure, operational and equipment needs. Vessel Operations must specifically plan for vessel replacement and retrofitting, size and speed, geographic scope of service, and other capabilities. Through this process, organizational resources can be prioritized and partnership opportunities identified and leveraged to address unmet needs.

GLERL's LMFS and Vessel Operations are coordinated to provide safe, reliable, and innovative service to

support integrated scientific research for NOAA and external partners. In addition, both the field station and vessels provide opportunities for communication, outreach, and education for NOAA and partners, academic institutions, and local and regional communities. Integral to GLERL's Vessel Operations is planning for short-term and future needs, driven primarily by scientific goals and objectives.

Guiding Principles

- Facilitate the conduct of field science (e.g., observations and process studies) that meet the requirements for GLERL researchers, NOAA interests in the Great Lakes, and partner institutions.
- Achieve safety and regulatory compliance in all aspects of operations and asset management for GLERL's field station and vessels.
- Maintain uninterrupted vessel service by addressing unmet needs on a proactive basis.
- Establish resources and systems for best management of vessel material condition and platform effectiveness.
- Advance marine technology initiatives that support NOAA's stewardship and operational goals.
- Invest in personnel development and create career path opportunities.
- Embrace the "One NOAA" concept through support of all NOAA interests in the Great Lakes region and contribute to NOAA's priorities for vessel management.
- Provide value as a national, regional, and community resource.

Lake Michigan Field Station

The LMFS houses laboratory facilities, supporting GLERL research focused on long-term ecological observations, fundamental research on ecosystem processes, and the development of models critical to understanding ecosystem structure and function. Outcomes from this research play an important role in managing water quality, fisheries, and other ecosystem services in the Great Lakes. The base-funded LTR program on Lake Michigan—a flagship monitoring program led by EcoDyn—integrates a core set of long-term observations on biological, chemical, and physical variables, with short-term process studies and field experiments for understanding and forecasting ecosystem change. The field station's proximity to Lake Michigan LTR sites provides the capacity to process time-critical samples immediately after collection in the LMFS EcoDyn laboratory and to sample during natural events (e.g., upwelling, spring flooding) or short weather windows during inclement periods. The LTR program is unique among federal agencies and academic institutions in its long-term commitment to seasonal observations of pelagic and benthic food webs in nearshore, transitional, and offshore waters.

By providing direct access to Lake Michigan, as well as the other Great Lakes, the LMFS not only contributes to the success of observation-based programs, but also supports the conduct of in-depth process studies with potential for increasing complexity. Currently, plans are underway to reconstruct the LMFS Building 3, allowing for the science laboratories to be consolidated within one building, in complete compliance with safety regulations. Plans for the reconstruction of Building 3 will provide increased capacity for laboratory facilities needed to conduct process experiments that must be done with "fresh" organisms sampled directly from the field. This building project also plans to provide additional space for visiting scientists working with the EcoDyn group on critical issues.

Vessel Operations

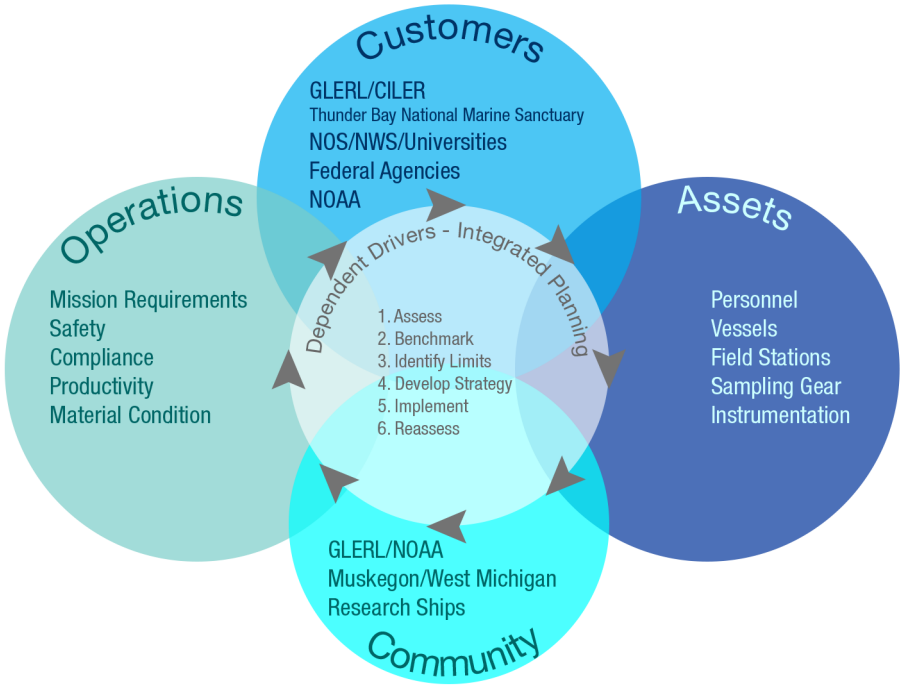
Important factors driving the operation of vessels at GLERL are science goals and objectives, operational requirements, and customer needs. It is imperative to provide a safe and secure work environment, support effective field operations, and operate in compliance with federal regulations. In addition to providing a platform in the conduct of GLERL integrated scientific research, valuable expertise is provided by GLERL's Vessel Operations to NOAA in the operation of small research vessels (SRV). The mobility of GLERL's vessel fleet also offers unique place-based opportunities for communications, education, and outreach at Great Lakes ports of call.

To address the challenges encountered in the operation of GLERL's vessels, consideration is given to the following business elements: addressing customer needs, providing effective capital and asset management, developing operations, and serving the community. Simultaneous examination of these elements, described below, provides a holistic and sustainable long-term strategy for vessel operations in meeting GLERL's research needs as well as those of other Great Lakes customers.

- Addressing Customer Requirements and Needs: Identify customers, partners, relationships, and responsibilities in the Great Lakes region.
- Managing Assets: Create a vessel inventory and fleet renewal plan based on customer requirements and best management of assets. As part of this element, maintain development of LMFS facility infrastructure in support of long term group activities e.g., scientific research and outreach.
- Developing Operations: Define resource capabilities and professional development plans accounting for long-term product development, vessel and customer requirements.
- Serving Community: Ensure peer and public engagement in the operations of vessels supporting research and outreach that is integrated with local, national, and regional community initiatives.

This comprehensive approach to the Vessel Operations strategy, inclusive of all of customer needs, helps to balance the cyclical nature of GLERL research. Changes in GLERL's geographic focus and scientific priorities are best supported by maintaining capabilities for a diverse customer base.

The management of GLERL's LMFS and Vessel Operations are guided by the following goals, paths, and milestones.



Strategic planning for vessel operations takes into account the business elements: customers, asset management, operations, and community through adaptive management principles. This allows for best utilization of resources, maintains core capabilities, and incorporates emerging technologies.

Goal 1: Established comprehensive, long-range plan for Vessel Operations that allows for capital management to ensure innovative and effective (uninterrupted) vessel service in support of GLERL science.

Paths (Objectives)

A. Define scope of operations (GLERL, regional or limited).
B. Identify customers, partners, relationships, and responsibilities in the Great Lakes region.
C. Create an organizational structure reflective of the requirements of items A and B.
D. Establish inter-agency agreements and memorandums of understanding that support items A, B and C.
E. Identify mechanisms to fund the Vessel Operations plan that do not compete with science needs.
F. Extend vessel scheduling to a three-year window.

Milestones

2016

- Host a workshop with GLERL principal investigators (PIs) to initiate planning on a two, five and ten-year cycle to identify vessel needs in response to science goals and paths/objectives for integration as the foundation for the Vessel Operations plan.
- Define scope of Vessel Operations (GLERL, regional, or limited) and draft organizational structure through GLERL's management team.

- Complete a needs assessment of vessel support, if required, for the Great Lakes region based upon workshop(s) with all NOAA interests and their partners.
- Establish, if required, a draft collaborative structure and funding plan among NOAA partners.
- Establish, if required, intra-agency agreements and external MOU's.
- Present capital and R&M (Repair & Management) budgets in a five-year format.
- Present staff resource requirements in a three-year format.
- Create a funding model to support multi-year capital plan.

2017

- Conduct a phased implementation of new scope of operations.
- Establish vessel schedule based on a three-year window.

Goal 2: Creation of vessel inventory and fleet renewal plan based on science goals and objectives, customer requirements, and best management of assets.

Paths

A. Identify resource priorities and potential partnerships to maintain a high-performing vessel fleet as the basis for establishing a vessel recapitalization plan.
B. Establish metrics for current fleet material condition and mission suitability.
C. Integrate fleet inventory with Vessel Operations plan to generate a 10-year requirements/assets matrix.
D. Acquire appropriate number and class of vessels to support customer requirements.
E. Maintain vessels to meet mission requirements and anticipate emerging technologies.

Milestones

2016

- Validate GLERL interest in a small research vessel (SRV) platform and renew RV Laurentian lease with end of service life defined.
- Complete rebuild of R4108, conduct sea trials and commission for service.
- Fully integrate the defined scope of operation (path/objective) with the fleet inventory requirements and define new/additional assets (renewal plan).
- Complete the Laurentian's 5-year dry-dock inspection (life cycle is established).
- Complete long-term SRV platform needs assessment and identify supporting partners, funding mechanisms and operational structure.
- Establish NOAA Great Lakes regional fleet panel with the representation needed to assess future vessel needs in the Great Lakes.

2017

- Implement year one of capital renewal plan.
- Assess regional fleet needs and develop funding strategy.

2018

- Request NOAA Headquarters to include SRV in the FY2019 Presidential Budget.

2019

- New SRV design contract is awarded.

2020

- New SRV building contract is awarded.

Goal 3: Defined resource capabilities and professional development plans reflective of long-term product, vessel, and customer requirements.

Paths (Objectives)

A. Define core capabilities and infrastructure to best support operation, mission, compliance, and technology requirements.
B. Establish a long-term staffing plan for vessel management, operations, and shore support positions.
C. Establish support infrastructure and equipment plan.
D. Develop opportunities for career path development and professional growth.
E. Explore opportunities to overcome limitations of seasonal field work.

Milestones

2016

- Complete core capabilities and associated infrastructure requirements report based upon current scope; draft requirements to reflect any changes in future scope.
- Create a scalable framework to define support requirements (personnel and equipment) that allows for phased implementation and personnel development.
- Scope out vessel-based science technician position.

2017

- Establish a five-year capability, infrastructure and equipment plan.
- Establish a three-year staffing plan.
- Establish a three-year personnel development plan.

2018

- Establish relationship with Office of Marine and Aviation Operations (OMAO) through NOAA Corps Officer Billet.
- Formalize regional priority and allocation process with agency partners, if required.

Goal 4: Development of LMFS facility infrastructure that will support long-term group activities in areas of scientific research, as well as communication and outreach.

Paths (Objectives)

A. Create plans for best utilization of current resources and achieve positive public image.
B. Explore agency, partner, and commercial infrastructure alternatives to meet projected requirements.
C. Plan for capacity building and sustainment of the LMFS, as feasible.
D. Integrate co-location of partners where there is mutual benefit.
E. Develop satellite dockage and shore resources.

Milestones

2016

- Assess current status of infrastructure and identify gaps, deficiencies, and corrective actions.
- Integrate LMFS science facility requirements with LMFS vessel facility requirements.
- Conduct an assessment of science needs for incorporation in the design of Building 3.
- Determine the feasibility of the Building 3 project based on available funds and footprint.

2017

- Complete Laurentian dock improvements.
- Complete improvements to conference meeting infrastructure.
- Award of Building 3 contract.
- Construction of Building 3.

2018

- Operation of Building 3.

GLERL Vessels

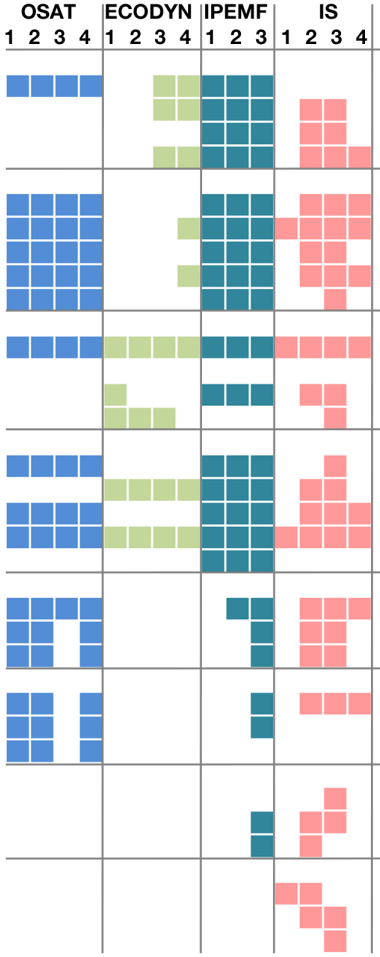
Three of GLERL's class III vessels secured at Thunder Bay Shores Marina in Alpena, Mich.

GLERL's class II fleet of research vessels.

The RV Laurentian currently plays a primary role in the conduct of GLERL's Great Lakes ecosystem research. However, since the Laurentian is approaching the end of its service life, steps are being taken to develop a vessel renewal plan, based on science goals and objectives, customer requirements, resource priorities, and potential partnerships.

Appendix F. Matrix Crosswalk: NOAA Goals/Objectives with GLERL Branch Goals

GLERL Branch Goals NOAA Goals and Objectives



NOAA Goals and Objectives
Science: Climate Adaptation & Mitigation
Improved scientific understanding of the changing climate system and its impacts
Assessments of current and future states of the climate system that identify potential impacts and inform science, service, and stewardship decisions
Mitigation and adaptation efforts supported by sustained, reliable, and timely climate services
A climate-literate public that understands its vulnerabilities to a changing climate and makes informed decisions
Science: Weather-Ready Nation
Reduced loss of life, property, and disruption from high-impact events
Improve freshwater resource management
Improve transportation efficiency and safety
Healthy people and communities due to improved air and water quality services
A more productive and efficient economy through information relevant to key sectors of the U.S. economy
Science: Healthy Oceans
Improved understanding of ecosystems to inform resource management decisions
Recovered and healthy marine and coastal species
Healthy habitats that sustain resilient and thriving marine resources and communities
Sustainable fisheries and safe seafood for healthy populations and vibrant communities
Science: Resilient Coastal Communities and Economies
Resilient coastal communities that can adapt to the impacts of hazards and climate change
Comprehensive ocean and coastal planning and management
Safe, efficient and environmentally sound marine transportation
Improved coastal water quality supporting human health and coastal ecosystem services
Safe, environmentally sound Arctic access and resource management
Education: Science-Informed Society
Youth and adults from all backgrounds improve their understanding of NOAA-related sciences by participating in education and outreach opportunities
Formal and informal educators integrate NOAA-related sciences into their curricula, practices, and programs
Formal and informal education organizations integrate NOAA-related science content and collaborate with NOAA scientists on the development of exhibits, media, materials, and programs that support NOAA's mission
Education: Safety and Preparedness
Youth and adults from all backgrounds are aware of, prepare for, and appropriately respond to environmental hazards that impact health, safety, and the economy in their communities
Formal and informal educators use and produce education materials and programs that integrate and promote consistent science-based messaging on hazards, impacts, and societal challenges related to water, weather, and climate
Formal and informal education institutions integrate water, weather, and climate hazard awareness, preparedness, and response information into curricula, exhibits, and programs that create learning opportunities for youth and adults
Education: Future Workforce
Students, particularly from underrepresented groups, consider education and career pathways in disciplines that support NOAA's mission
Postsecondary students, particularly from underrepresented groups, pursue and complete degrees in disciplines critical to NOAA's mission
Graduates completing NOAA-supported student opportunities continue education, enter the workforce, and advance in careers that support NOAA's mission
Education: Organizational Excellence
Leaders internal and external to NOAA recognize and support education investments as a way to achieve agency mandates, mission, and goals
NOAA educators and partners collaborate at local, regional, and national levels to coordinate efforts, build capacity, and better serve educational audiences
NOAA develops and supports a coordinated portfolio of products, programs, and partnerships that improves education opportunities in NOAA-related content areas for underserved audiences

[1] GLERL Science Branches:
OSAT- Observing Systems and Advanced Technology
EcoDyn - Ecosystem Dynamics
IPEMF - Integrated Physical and Ecological Modeling and Forecasting
IS - Information Services

[2] GLERL goals are indexed by science branch, and can be found on the next page.

GLERL Goals by Branch

Branch	Goal
OSAT	1. Expanded use and application of technology to enhance remote sensing capacity to assess ecosystem impacts and for use in modeling and operations. 2. Improved in situ observational capacity to increase number of sites and number of instruments and sensors at those sites. 3. Observational infrastructure (e.g., instrumentation and equipment, mobile and fixed platforms, and data management) provides reliability and flexibility needed for innovation on a long-term basis. 4. Operational capacity that supports research and the transition of products to operations.
EcoDyn	1. A holistic understanding of the role of established and potentially future invasive species on Great Lakes ecosystems. 2. An integrated understanding of the spatial organization of the food webs and nutrient use and transport from nearshore to offshore food webs. 3. The capacity to forecast effects of climate change on Great Lakes food webs. 4. A quantitative understanding of the drivers of HABs to predict their concentration, extent, movement, and toxicity.
IPEMF	1. Integrated modeling system to improve forecast capability of lake hydrodynamics, lake ice, hydrological response, ecological processes, water quality, and climatic variability and trends across spatial and temporal scales. 2. Enhanced/ improved capability for medium- and long-range forecasts by quantifying uncertainty and developing skill assessment tools (long-term, decadal scale climate) 3. Be a trusted scientific leader on prediction of high impact or extreme events, including prediction on water issues of regional and national significance.
IS	1. A collaborative organizational environment that fosters information flow, transparency, trust, and a team-building approach, and enhances the functionality of GLERL programs and staff. 2. Increased awareness and understanding of GLERL expertise, programs, products, and services among other NOAA programs, NOAA leadership and Congress. 3. Information needs of constituent groups (e.g. other governmental agencies, resource managers, decision makers, researchers, media, private industry, educational institutions, NGO's, general public) in the Great Lakes region are met. 4. Recognition of NOAA GLERL as a resource for research products and services utilized by constituent groups and partners in the Great Lakes and beyond.

Appendix H. Lifecycle Management of Critical Equipment

GLERL takes a lifecycle management approach to plan in the near and long term for new costs, and to identify emerging needs as well as obsolete equipment. In the conduct of scientific research, GLERL's depends on numerous pieces of equipment, many of them state-of-the-art. Lifecycle management of GLERL's critical equipment involves maintaining a list of equipment valued at ≥ $10,000, maintaining the equipment for the life of each item, and planning for funds to replace equipment as needed. In the document below, the value and replacement costs of GLERL's critical equipment is listed to assist leadership in projecting costs to maintain GLERL's equipment in efforts to ensure uninterrupted conduct of GLERL research.

Below is a summary of the monetary value of GLERL's critical equipment and expected replacement costs.

Total value of critical equipment	$16,108,931.04
Cost of equipment due for replacement in <5 years	$ 2,250,545.00
Cost of equipment due for replacement in 5-10 years	$ 4,198,691.00
Cost of equipment due for replacement in >10 years	$ 4,292,691.00
Cost of GLERL vessel replacement or overhaul	$17,240,000.00

Replacement Date/ Comments	*Description*	*Manufacturer*	*Model number*	*Serial number*	*Asset Value*	*Date bought*	*Replacement or First-Time Purchase Cost*
< 5 years	Meter, Ocean Current	Teledyne Technologies Incorporated	WHS300	155	22,135.00	11/14/1996	25,000
< 5 years	Meter, Ocean Current	Teledyne Technologies Incorporated	WHS1200	376	22,135.00	9/26/1997	25,000
< 5 years	Meter, Ocean Current	Teledyne Technologies Incorporated	WHS300	1057 CD0000771656	23,388.60	9/17/1999	25,000
< 5 years	Meter, Ocean Current	Teledyne Technologies Incorporated	WH5-300	3682	28,933.40	12/29/2003	25,000
< 5 years	Meter, Ocean Current	Teledyne Technologies Incorporated	WH5-300	3748	28,933.40	12/29/2003	25,000
< 5 years	Meter, Ocean Current	Teledyne Technologies Incorporated	WH Sentienel (600 series??)	5315	28,093.40	10/4/2004	25,000
< 5 years	Sensor, Temperature, Conductivity	YSI Incorporated	6600	NONE	10,582.50	6/15/2005	15,000
< 5 years	Sensor, Temperature, Conductivity	YSI Incorporated	6600	NONE	10,582.50	6/15/2005	15,000
< 5 years	Meter, Ocean Current	Teledyne Technologies Incorporated	WHS600	6231	18,343.75	6/30/2005	25,000
< 5 years	Meter, Ocean Current	Teledyne Technologies Incorporated	WHS600	6231	18,343.75	6/30/2005	25,000
< 5 years	Sensor, Temperature, Conductivity	YSI Incorporated	6600 EDS-S	NONE	21,812.00	8/12/2005	15,000
< 5 years	Sensor, Temperature, Conductivity	YSI Incorporated	6600 EDS-S	NONE	21,812.00	8/12/2005	15,000
< 5 years	Geophysical Instrument	Brooke Ocean Technology Limited	6602	10389	50,298.00	12/9/2005	50,000
< 5 years	Acoutistic Doppler Velocimeter	Teledyne Technologies Incorporated	600 ADCP	8426	17,850.00	1/31/2007	25,000
< 5 years	Radiometer	Satlantic	HPR	151	42,895.25	6/19/2012	43,000
< 5 years	Sensor	Satlantic	REF	414	10,433.75	6/19/2002	30,000
< 5 years	Telephone, Satellite	Thrane and Thrane, Inc.	Sailor 500 Fleetbroadband	12434138	12,246.70	12/3/2012	12,250
< 5 years	Sensor	Wet Labs, Inc.	ECO BB9	1090	24,956.90	2/27/2014	25,000
< 5 years	Two Frequency Fisheries Acoustics	Biosonics, Inc.	Ecosounder P86860	3D Scientific	75,799.34	7/16/2009	75,000
< 5 years	Meter, Ocean Current	Nortek	Aquadopp 2MHZ	AQD6724	13,018.00	11/19/2009	15,000
< 5 years	Sensor, Current	Nortek	Aquadopp 600 KHZ	WAV6256	25,398.49	10/24/2012	20,000
< 5 years	Television	LG Electronics	DU42PX12XC	509RMPG02784	14,097.94		1500
< 5 years	Recorder, Depth	Biosonics, Inc.	DTX	DTX-04-055	33,451.17	6/24/2004	33,500
< 5 years	Incubator, Laboratory	Percival Scientific, Inc.	I36VL	20795.01.14K	10,245.00	3/13/2015	12,000
< 5 years	Communications Controller	Mitel Networks	3300 MXE II	56008742A	62,287.40	2/3/2009	80,000
< 5 years	Video Conferencing System	Polycom, Inc.	VSX 7000	82053806605CAK	20,982.98	10/17/2005	20,000
< 5 years	Computer, Server	Silicon Graphics, Inc.	OC3-2TY12/CMN500	CH100063	61,017.25	1/14/2011	20,000
< 5 years	Computer, Server	Silicon Graphics, Inc.	OC3-2TY12/CMN500	CH100062	61,017.25	1/14/2011	20,000
< 5 years	Computer, Server, Rackmout	SGI	C2108 Head Node	X1001143	102,338.90	1/11/2012	60,000
< 5 years	Bundle - IT hardware needed (computers, etc.)	NA	NA	NA	150,000.00	NA	194,000
< 5 years	Buoy	Fondriest	CB-500			2013	25,000
< 5 years	Buoy	Fondriest	CB-500			2013	25,000
< 5 years	Buoy	Fondriest	CB-500			2013	25,000
< 5 years	Buoy	Fondriest	CB-500			2013	25,000
< 5 years	YSI EXO2						20,000
< 5 years	YSI EXO2						20,000

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< 5 years	YSI EXO2						20,000
< 5 years	YSI EXO2						20,000
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< 5 years	YSI EXO2						20,000
< 5 years	YSI EXO2						20,000
< 5 years	YSI EXO2						20,000
< 5 years	Suna-N nitrate sensor	Satlantic					125,000
< 5 years	Suna-N nitrate sensor	Satlantic					125,000
< 5 years	Camera, towed	GLERL			25,000.00		30,000
< 5 years	Unmanned Air Systems (Three drones, two different types)						70,000
< 5 years	Buoy	Recon	Model-D		50,000.00	2008	70,000
< 5 years	Buoy	Recon	Model-D		50,000.00	2008	70,000
< 5 years	Buoy	Recon	Model-D		50,000.00	2008	70,000
< 5 years	Buoy	Recon	Model-D		50,000.00	2008	70,000
< 5 years	Meter, Ocean Current	Sontek/YSI, Inc.	5MZ	1369	17,966.75	11/10/1997	15,000
< 5 years	Environmental Sample Processor	McLane Research	G2 Core	13439-01	179,400.00	1/12/2016	179,400.00
< 5 years	Environmental Sample Processor accessories (including pressure housing, mooring/telecoms, deployment base, and pucks)				150,000.00		150,000
5-10 years	Single Frequency 120 KHz Fisheries Acoustics	Biosonics, Inc.	Ecosounder	3D Scientific	40,000.00	2013	40,000
5-10 years	Generator, signal, impulse, electric	Agilent Technologies, Inc.	E4422B	SG43350101	14,758.16	12/3/2003	15,000
5-10 years	Generator, signal, impulse, electric	Agilent Technologies, Inc.	E4400	US3844087	42,037.00	12/6/2004	40,000
5-10 years	Meter, Ocean Current	Sontek/YSI, Inc.	ADP 3.0	M305	14,740.00		17,000
5-10 years	Buoy	Fondriest Environmental, Inc.	60-33	1	11,380.00	12/8/2005	11,380
5-10 years	Recorder, Temperature, Non-Merolog	Sea-Bird Electronics, Inc.	Seacat Profiler CTD SBE 19 Plus	19P51607-6337	17,216.75	9/1/2009	15,000
5-10 years	Recorder, Temperature, Non-Merolog	Sea-Bird Electronics, Inc.	Seacat Profiler CTD SBE 19 Plus	19P57237-6619	10,138.25	11/5/2010	15,000
5-10 years	Meter, Ocean Current	Nortek	Aquadopp 2MHZ	ASP-26045	12,558.00	11/7/2007	13,000
5-10 years	Meter, Ocean Current	Nortek	Aquadopp 2MHZ	ASP-260	12,558.00	11/7/2007	13,000
5-10 years	Truck, lift, fork	Toyota	8FBCU32	60798	20,766.00	10/26/2011	20,766.00
5-10 years	Meter, Ocean Current	Nortek	Aquadopp 2MHZ	AQD8062	12,558.00	11/7/2007	13,000
5-10 years	Meter, Ocean Current	Nortek	Aquadopp 2MHZ	AQD8126	12,558.00	11/7/2007	13,000
5-10 years	Meter, Ocean Current	Nortek	Aquadopp 2MHZ	AQD8119	12,558.00	11/7/2007	13,000
5-10 years	Meter, Ocean Current	Nortek	Aquadopp 2MHZ	AQD8068	12,558.00	11/7/2007	13,000
5-10 years	Meter, Ocean Current	Nortek	Aquadopp 2MHZ	AQD8134	12,558.00	11/7/2007	13,000
5-10 years	Meter, Ocean Current	Nortek	Acoustic Doppler AWAC 600KH	6110	25,030.00	6/28/2011	25,000
5-10 years	Meter, Ocean Current	Nortek	Acoustic Doppler AWAC 600KH	6111	25,030.00	6/28/2011	25,000

5-10 years	Sensor	Wet Labs, Inc.	SDI-12 (Cycle P)	184	12,472.25	2/27/2014	14,000
5-10 years	Sensor	Wet Labs, Inc.	SDI-12 (Cycle P)	186	12,472.25	2/27/2014	14,000
5-10 years	Spectrophotometer	Wet Labs, Inc.	AC-S	144	28,509.25	2/27/2014	30,000
5-10 years	Meter, Ocean Current	Nortek	Acoustic Doppler AWAC 600KH	6873	19,929.47	6/23/2014	25,000
5-10 years	Meter, Ocean Current	Nortek	Acoustic Doppler AWAC 600KH	6788	19,929.47	6/23/2014	25,000
5-10 years	Sensor	Sea-Bird Electronics, Inc.	SBE49 Fastcat	49-0354	10,535.75	7/23/2014	10,600
5-10 years	Recorder Temperature, non-meterological	Sea-Bird Electronics, Inc	19 ~283308~	09R13855-0595	21,547.35	4/19/1995	21,000
5-10 years	Analyzer, Chemical	Elantech, Inc.	EA1110	117171450	41,100.00	12/4/1998	35,000
5-10 years	Lab Equipment & Supplies	Applied Biosystems	Real Time PCR-System 7500	275010255	45,908.00	5/7/2014	100,000
5-10 years	Freezer	Nor-Lake	Ultra Low NSSUF241WWW/O	13110320	10,465.00	6/9/2014	25,000
5-10 years	PCR System	Quantstudio	DPCR Proplex 3DPackage	237270647	42,115.87	10/8/2014	100,000
5-10 years	Microcscope	Leica Microsystems	DM6000	NONE	87,162.12	11/30/2005	100,000
5-10 years	Particle Size Analyzer	Fluid Imaging Technologies	Flow Cam B3VS4	STL1110LPC36531	94,015.00	1/9/2012	150,000
5-10 years	Detector	Packard Instruments	2500TR	403636	29,056.00	8/16/1993	
5-10 years	Recorder, Depth	Biosonics, Inc.	DTX	DTX-14-351	15,313.34	12/6/2014	15,000
5-10 years	Analyzer	Seal Analytical	Quatro SFA Analyzer	8008287	46,526.00	3/29/2012	70,000
5-10 years	Calorimeter	Fisher Scientific International, Inc.	1261	NA	20,262.87	9/2/1998	30,000
5-10 years	Microscope	Leitz	DMRHC	211358	39,567.43	7/19/1999	50,000
5-10 years	Recorder, Tempreature, Non-Meterolog	Sea-Bird Electronics, Inc.	Seacat Profiler CTD SBE 19Plus	19P61469-6659	10,068.25	1/19/2011	15,000
5-10 years	Camera, Digital	Leica Camera AG	Digilux 1	09023511	11,980.72	11/23/2011	11, 000
5-10 years	Fluorometer (WE HAVE 3)	Turner Designs, Inc.	10AU-005-CE	1100214	15,345.53	5/8/2012	15,000
5-10 years	Microscope	Nikon Intruments, Inc.	ECLIPSE TS100F	533663	13,083.78	11/17/2010	13,000
5-10 years	Measuring Tool, Light	Satlantic	In Situ Fire	011	25,576.50	7/13/2012	30,000
5-10 years	Microscope, Inverted	Leica Microsystems	DMI6000	348507	87,734.54	10/26/2011	88,000
5-10 years	Radiometer	Biospherical Instruments, Inc.	PUV-2500	25000512128	19,995.00	10/31/2012	20,000
5-10 years	Fluorometer (WE HAVE 3) - is this one of them??	BBE Moldaenke	Fluoroprobe III	TS22-14	24,891.30	12/11/2012	25,000
5-10 years	Radiometer	Biospherical Instruments, Inc.	PUV-2510	25101012128	10,995.00	2/26/2013	11,000
5-10 years	Mochness System	Bess Mfg	1m2	GL-1	75,750.00	8/1/2014	120,000
5-10 years	Plankton Survey System						150,000
5-10 years	Environmental Sample Processor	McLane Research	G2 Core	13439-01	179,400.00	1/12/2016	179,400.00
5-10 years	Environmental Sample Processor accessories (including pressure housing, mooring/telecoms, deployment base, and pucks)				150,000.00		150,000
5-10 years	Core System Loader	MFG	QS3D DPCR	237270647	42,115.87	9/15/2015	42,000.00
>10 years	Freezer (walk-in cold room?)	Norlake	J72301R	7712170	11,699.00	12/1/1978	20,000
>10 years	Hydrographic Survey Equipment	Quester Tangent	QTC VIEW	Q13065	24,000	1/18/2011	24,000
>10 years	Instruments, Miscellaneous	Accuri Cytometers, Inc.	Phytocyt Flow Cytometer C6 7100-000	2966	39,000	10/25/2011	50,000

Already replaced	Flurometer	Aquatrak Corporation	Mark III	NONE CD0000697939	11,605.60	10/29/1997	NA
Already replaced	Meter, Ocean Current	Teledyne RD Instruments	Workhorse ADCP Sentinel	16925	12,302.50	1/24/2012	NA
Already replaced	Radiometer	Satlantic	SMSR	044 CD0000697920	23,934.37	9/27/1997	NA
Already replaced	Radiometer	Satlantic	SPMR	019 CD0000697921	34,000.00	9/27/1997	NA
Already replaced	Test Equipment, Physical Properties	Focal Technologies, Inc.	NOMOD ~153931~	2T-0005	18,390.00	1/10/1997	NA
Already replaced	Network, Server	Dell, Inc.	Poweredge 6850	3JNYD1	15,829.00	11/7/2007	NA
Annually	Backup Server Software	Bacula	NA	NA	13,280.00	2/26/2016	13,000
Do not replace	Measure, Liquid, Laboratory	Waters	600E ~199652~	6PLEPL159	11,100.00	7/25/1991	NA
Do not replace	Detector	Waters	991	99109110166	23,000.00	7/25/1991	NA
Do not replace	Extraction System	Suprex	S-700 ~314160~	S-700024	22,175.63	7/29/1992	NA
Do not replace	Analyzer	Shimadzu Scientific Instruments	TOC-5000~46405~	28209432	17,031.00	6/28/1991	NA
Do not replace	Centrifuge	IEC	B-22M	34950036	14,180.50	6/8/1992	NA
Do not replace	Analyzer	No MFG	Analyzer	74A206661	11,540.00	4/1/1976	NA
Do not replace	Colorimeter	Bran+Luebbe, Inc.	AACE	9522371	18,000.00	10/23/2000	NA
Do not replace	Microscope	Aus Jena Sedival	NOMOD	742225	17,306.00	3/7/1988	NA
Do not replace	Spectrophotometer (was incorrected labeled spectrometer in Sunflower database)	Perkinelmer, Inc.	Lambda 40	101N8011445	18,920.00	7/28/1998	NA
Do not replace	Fathometer	EG&G Marine Instruments	260th	16669	40,592.40	4/23/1993	NA
Do not replace	Network, Server	Dell, Inc.	Poweredge R710	3LPXNN1	15,603.87	1/18/2011	NA
Not currently used	Liquid Scintilation Counter	Perkinelmer, Inc.	Counter	HR62J71	17,377.76	10/23/2000	NA
Not currently used	Chemical Analysis Instruments	Heinz Walz GMBH	Phyto-Pam Phyto-C	PPAA0167	32,000	5/16/2014	NA
Not currently used	Camera, Digital	LNG	A8703 ~299788~	NONE CD0000511671	24,700.00	9/30/1991	NA
5-10 years	Core System Loader	MFG	QS3D DPCR	237270647	42,115.87	9/15/2015	42,000.00
Not planning to replace; end of service life 2025	RV, Class A	R1301, RV No Name (status=active), Class A	(HIN) MAK405311288	CD0000296305	5,000	1976 (year built)	NA
Not planning to replace; end of service life 2020	RV, Class A	R1501, RV No Name (status=active), Class A	(HIN) MAK405311288	CD0000296305	25,000	1976 (year built)	NA
Not planning to replace; end of service life 2018	RV, Class I	R2106, RV No Name (status=active), Class I	(HIN) MAK405480189	CD0001680500	25,000	1989 (year built)	NA
Not planning to replace; end of service life 2020	RV, Class I	R2306, RV No Name (status=active), Class I	(HIN) SAMA0646Jj595	CD00001666777	32,000	1995 (year built)	NA
Not planning to replace; end of service life 2017	RV, Class I	R2506, RV No Name (status=active), Class I	(HIN) BWC8C571J899	CD0001596025	21,000	1997 (year built)	NA
Not planning to replace; end of service life 2017	RV, Class I	R1102, RV No Name (status=active), Class I	(HIN) MAK405311288	CD0000296305	8,000	1976 (year built)	NA

10 K to overhaul; overhaul date 2025	RV, Class II	R2601, RV CYCLOPS (status=active), Class II	(HIN) SAMA0245D191	CD000045394	110,000	1974 (year built)	200,000
22 K to overhaul; overhaul date 2025	RV, Class I	R2512, RV No Name (status=active), Class I	(HIN) SAMA1205C101	CD0000819546	160,000	2001 (year built)	180,000
22 K to overhaul; overhaul date 2020	RV, Class II	R2604, RV No Name (status=active), Class II	(HIN) SAM0126D999	CD0001666776	160,000	2001 (year built)	180,000
22 K to overhaul; overhaul date 2025	RV, Class II	R3011, RV No Name (status=active), Class II	Pending registration	Pending registration	160,000	2005 (year built)	180,000
Not planning to replace; end of service life 2017	RV, Class II	R3202, GLERL (status=inactive), Class II	(HIN) SJQ30123G292	CD0001695263	60,000	1992 (year built)	110,000
30 K to overhaul; overhaul date 2022	RV, Class III	R4108, RV No Name (status=active), Class III	(HIN) CG41486	CDN0001461519	270,000	1979 (year built)	390,000
85 K to overhaul; overhaul date 2019	RV, Class III	R5002, RV Storm, (status=active), Class III	(HIN) 502001	CD0001666778	1,100,000	1996 (year built)	1,800,000
85 K to overhaul; overhaul date 2020	RV, Class III	R5501, RV No Name (status=active), Class III	(HIN) CG55112	CD0001666775	1,400,000	1974 (year built)	2,200,000
220 K to overhaul; overhaul date 2018	RV, Class SRV	R8001, RV LAURENTIAN (status=active), Class SRV	(HIN) 557024	CD0001059893	6,000,000	1974 (year built)	12,000,000
NA	Scanner, Document Imager	Alpha Innotech Corporation	Alphaimager	502987	10,490.00	8/16/1993	30,000
NA	Prefabricated Building	Safety Storage, Inc.	12FSW/10	2325	17,139.00	2/2/1997	NA
NA	Stereomicroscope	Leica Microsystems	MZ16	5312012	12,351.47	12/9/2004	NA
NA	Spectroflouormeter	PP Systems	Fluoroprobe 3 BG35000-V	TS23-15	26,860.50	12/9/2014	40,000